ISSN No:-2456-2165

An Efficient Heartbeats Classifier Based on Convolutional Neural Network

V . PURUSHOTHAMAN
ASSOCIATE PROFESSOR.
VEL TECH UNIVERSITY
VELTECH RANGARAJAN DR SAGUNTHALA R
and D INSTITUTE OF SCIENCE AND TECHNOLOGY CHENNAI, INDIA

SHAIK CHANDINI, DONELLI BABY SRILAKSHMI, KONDAMURU SRI AKHILA
ECE DEPARTMENT VEL TECH UNIVERSITY CHENNAI, INDIA

Abstract:- Recently, deep learning models have arrived as assuring methods for the diagnosis of various diseases. Cardiac disease is one of the leading life-threatening diseases on global scale. The aim of this paper is to propose a heartbeat classifier from the electrocardiogram by using CNN. The proposed Electrocardiogram classification model is designed with a CNN configuration to classify heartbeat arrhythmias in less time. Already existing designs like machine learning techniques are time-consuming and needs extensive experimentation. To overcome this problems, we are using CNN model for ECG Classification.

Keywords:- *ECG analysis, cardiac arrhythmias, ECG classification, deep learning and convolutional neural networks.*

I. INTRODUCTION

In cases with suspected arrhythmias, doctors often ask the patients to wear a Holter to continuously record ECG data for 24 hours or longer. Because the amount of ECG data recorded by the Holter is very large, it is compulsory to examine the recordings using a computer and designate the type of each heartbeat automatically. According to the AAMI (Association for the Advancement of Medical Instrumentation), ruinal threatening arrhythmia signals can be divided into five categories: non-ectopic beat (N), supra ventricular ectopic beat (SVEB, S), ventricular ectopic beat (VEB, V), fusion (F), and known (Q).

CNN have also become a famous option to automatically classify ECG signals recorded by the Holter. Compared with traditional methods, the CNN classifier can prompt the input heartbeats without extra feature extraction and selection; it also establish competitiveness in classification efficiency. More models on arrhythmia heartbeat classification with CNN have been designed. A heart arrhythmia is an abnormal heartbeat. Heart beat problems (heart arrhythmias) happens when the electrical signals that correspondant the heart's beats don't work normally. The wrong signaling create the heart to beat too fast (tachycardia), too slow (bradycardia) or irregularly. Cardiac arrhythmia is the situation in which the heart's normal rhythm is changed. So, To classify the heartbeats CNN model is a quick and easy process.

II. EXISTING TECHNIQUE

Electrocardiogram (ECG) signal is a procedure that records the heart rate by using electrodes and detects tiny electrical changes for every heart rate. It is used to research some types of abnormal heart function involves arrhythmias and conduction disturbance. In that , the proposed method is used to categorize the ECG signal by using machine learning classification method. First the Input electrocardiogram signal is preprocessed by using filtering technique. After preprocessing, extracting the features for the signal are obtained by using statistical parameters. Finally, extracted features are categorized by using SVM. Totally four classifiers are used to categorize the ECG signal database such as ANN, SVM, Adaboost and Naïve bayes classifier. These classifiers categorize the ECG signal into normal or abnormal ECG signal. The accuracy of the SVM classifier is 87.5%.

Therefore, machine learning techniques are time-consuming process.

III. PROPOSED SYSTEM

The block diagram of the project is shown in the below figure

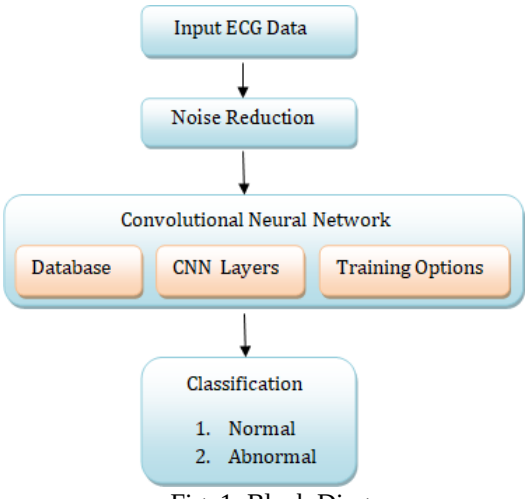

Fig. 1: Block Diagram

The diagram contains following blocks.

ISSN No:-2456-2165

A. Data Collection

The input dataset contains of (CSV) files, each row represents a signal in the dataset. MIT-BIH arrhythmia dataset is utilized.

B. Denoising

In this stage the noise produced while taking the ECG records will be removed. And it will help to get the accurate result or to classify the type of heart beat.

C. CNN

We have planned CNN classifier for ECG beats signals. This framework is worked from convolutions, pooling and ReLu layer, which has been utilized as activation task after convolution layer, in this strategy we utilized (ReLU) as activation task. To diminish how much the extra fitting, batch normalization is added, which can make the network more study, this is executed by avoid the average batch and centralized it by using standard deviation. The convolution layer rotate the layers output with filters by dot product them as per introduced the size of window, in this method, Convolution layer with window size (3*3) while pooling layer is use to down examining the result by picking the more number for each (2*2) window. The CNN model is portrayed as displayed in figure. As displayed in figure, three convolution layers with 64 channel are given consecutively, then, at that point, greatest pooling strategy with pool size (2*2)is use to deduct the size of the information, then two convolution layers with filters 128 is use trailed by most extreme pooling layer(2*2),then one more convolution layer have 256 channel is used to get the highlight details , third max pooling layer is used to deduct the information to least area, then completely, dense and soft maximum layers are utilized to sort the information into five kinds based on the extracted characteristics.

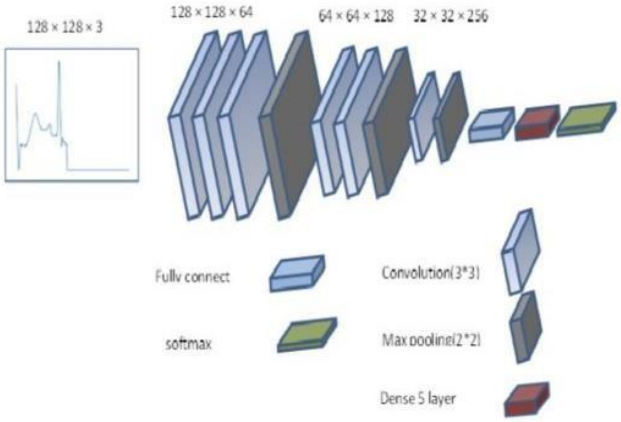

Fig. 2: The Structure of the 2D CNN model

IV. METHODOLOGY

When it comes to artificial neural network work really well. Artificial Neural Networks are used in different types of classification tasks like image, audio, words. Various types of Neural Networks are utilized for various purposes, for example for getting the serial of words we use Recurrent Neural Networks more offently an LSTM, similarly for image categorization we used Convolution Neural Network.. A convolutional neural network can have one or more convolutional layers. The number of convolutional layers based on the amount and difficulty of the data. CNN is also more efficient. It uses special convolution and pooling modules and works parameter sharing. This enables CNN models to work on any device, making them universally best. The raw signal is corrupted by noises such as powerline interference, baseline wander etc. We have proposed two CNNs model, the first model is one dimension model, which is used one dimension signal(CSV dataset), the second model is two dimensional model, which is used two dimension signal (image) as input, this signal can be constructed by converting1-D signal (csv data) into image. Two dimension model is very important because it is used data augmentation, which increase the accuracy of the classification. To remove those noises, the raw ECG signal is denoised by using wavelet filters. This model is constructed from convolution layers, pooling and dense layer in addition to other layers like rectifier layer unit. After the feature extraction of image, these models are trained and tested by using MIT-BIH dataset and image will be classified as normal or abnormal heartbeat. The major advantage of CNN compared to others is that it automatically gets the important features without any human interaction.

V. RESULTS

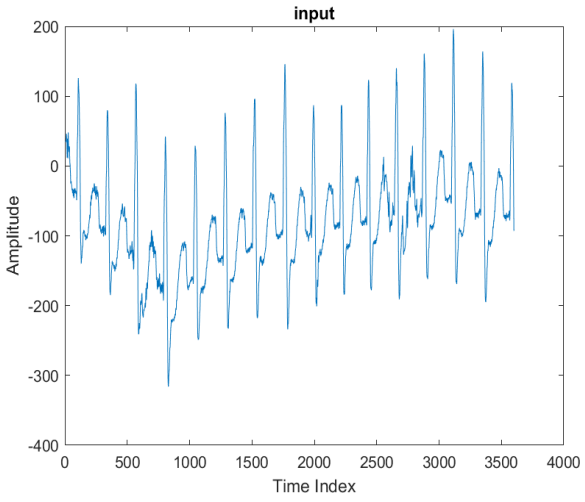

Fig. 3: Input Signal

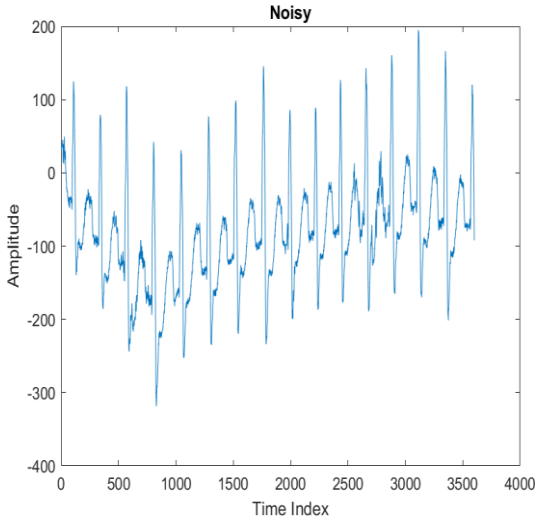

Fig. 4: Noisy Signal

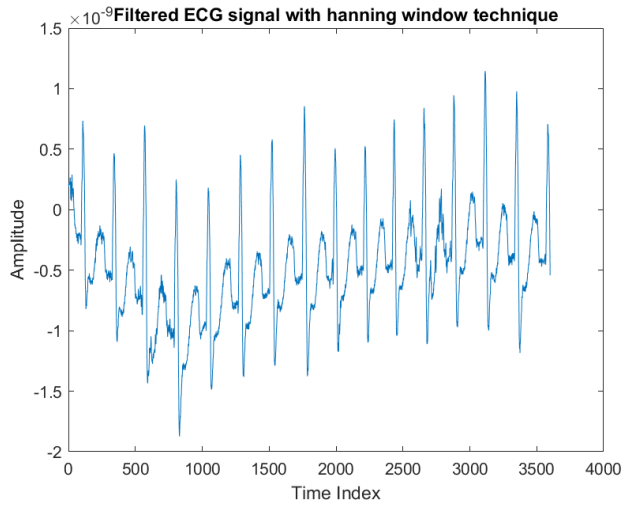

Fig. 5

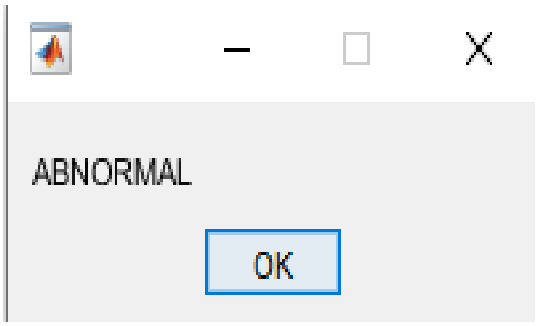

Fig. 6: Message Box Output

VI. CONCLUSION

The paper is mainly designed to classify the types of the heart beats based on the ECG signal that we are taking as the input. In this study, we designed an efficient heartbeats classifier based on convolutional neural network technique. Electrocardiography is used to help diagnose different heart conditions by electrocardiogram signal monitoring. It was proved experimentally the classification of Electrocardiogram (ECG) heartbeat data whether it is normal or abnormal using CNN.

REFERENCES

[1.] Y. Ping, L. Wu "Automatic detection of atrial fibrillation based on CNN-LSTM" , *Healthcare*, vol. 8, no. 2, pp. 139, May 2020.

[2.] Gao, J, Lu and Wang, Z. (2019). An effective LSTM recurrent network to detect arrhythmia on imbalanced ECG dataset. *J. Healthcare Engin.*2019..

[3.] Y. Xiang, X. Xiang, ''Electrocardiogram based heartbeat classification using 2d convolutional neural network and RR interval difference,'' IEICE Trans. Inf. Syst., vol. E101-D, no. 4, pp. 1189–1198, 2018.

[4.] N. T. Srinivasan and R. J. Schilling, "Sudden cardiac death and arrhythmias,"vol. 7, no. 2, 2018.

[5.] J. Takalo-Mattila, J. Kiljander, and J.-P. Soininen, "Inter-patient Electrocardiogram classification using deep convolutional neural networks," in 2018, pp. 421–425.

[6.] X. Zhai and C. Tin, ''Automated ECG classification using dual heartbeat coupling based on convolutional neural network," IEEE Access, vol.6, pp.27464-27472,2018

[7.] U. R. Acharya, S. L. Oh, Y. Hagiwara, J. H. Tan, M. Adam, A. Gertych, and R. S. Tan, ''A deep convolutional neural network model to classify heartbeats," comput.Biol.Med, vol. 89,pp. Oct.2017.